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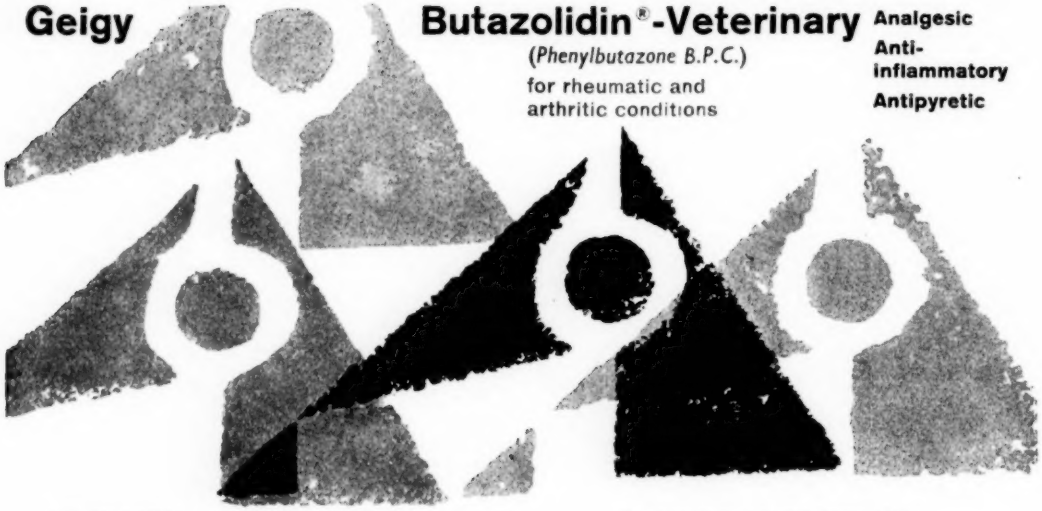

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Some Nutritional and Other Inter-acting Factors which may Influence the Fertility of Cattle*

BY

S. L. HIGNETT

The Wellcome Veterinary Research Station, Frant, Sussex

I AM indeed pleased to have this opportunity of telling members of the Society for the Study of Animal Breeding something about the work on reproduction which we have been doing at Frant for several years past. I propose to deal, in the main, with unpublished data—mostly derived from work as yet incomplete. Consequently, some deductions made will be highly speculative.

Until comparatively recently there have been frequent references to the effect of such environmental factors as climatic conditions, hours of daylight and nutrition, on bovine fertility, but few statements have been supported by good experimental evidence or, for that matter, by accurate clinical observation. During the last decade, however, a considerable mass of reliable information has been accumulated. This points unerringly to the importance of a number of factors, other than infection and heredity, which singly or combined, influence the reproductive efficiency of cattle. Thus, Edwards (1950), James (1950), and VanDemark (1952) have shown conclusively that the length of the calving-service interval has a marked effect on conception rate; in that as the period is increased up to about 10 weeks, there is a significant rise in fertility. Laing (1955) found that the amount of light had no marked influence on the fertility of his experimental heifers, while Mercier and Salisbury (1947), using records of 150,000 artificial inseminations, concluded that the overall fertility of cattle was closely correlated with hours of daylight; there being a lag of 1 to 2 months before the maximum effects of the variation were reached. At the same time they reported that atmospheric temperature had little influence on the conception rate of cattle in Eastern Canada. Gould and Bennett (1950) have drawn attention to the adverse effect of over-work on the breeding performance of bulls at an A.I. centre. Wilson (1952), Ford (1956), Brochart (1956, 1957), and Munro (1957) have all produced evidence to indicate that dietary mineral levels influence reproductive efficiency in cattle.

Work at the Wellcome Veterinary Research Station has shown clearly that calcium, phosphorus, manganese, copper, iodine, and vitamin D can have a marked influence on the breeding performance of cattle (Hignett, 1950; Hignett & Hignett, 1951, 1952, 1953; Hignett, 1956, 1957). The results of the vitamin D observations supported the views of Abrams (1952), namely, that when phosphorus intake is low, the adverse effect of a wide calcium-phosphorus ratio largely disappears when the vitamin D status of the animal is high. Furthermore, it has been demonstrated that grassland management will affect both the fertility of grazing animals and the mineral levels of the pasture herbage (Hignett, 1950, 1957).

Perhaps the most interesting feature of these findings, is the extent to which calcium and phosphorus consumption will determine the levels of manganese required for a high conception rate. Another important deduction relates to the way in which increased growth rate depresses still further the fertility of heifers if dietary calcium and phosphorus are not balanced and the manganese level is low (Hignett, 1956). These findings, together with more recent observations, in the main similar to those already described, but with the range of calcium, phosphorus,

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and manganese levels extended, have shown that, with a low manganese consumption (less than 40 mg. elemental manganese per 100 lb. bodyweight), fertility is high when calcium and phosphorus are well balanced (the value for x_1 or $\frac{P^2*}{Ca}$ being between 1.0 and 2.0), but when calcium is excessive relative to phosphorus or vice versa and the manganese low, fertility is depressed. On the other hand, when manganese exceeds 100 mg. per 100 lb. bodyweight, then the best breeding performances are achieved with calcium excessive, relative to phosphorus, or vice versa (x_1 being less than 0.5 or greater than 3.75 respectively), the lowest fertility occurring between x_1 values of 0.5 and 3.75.

The formula for x_1, like that for x used previously by Hignett (1956) when $(P_2O_5)^2$ was divided by CaO and where the values for both P_2O_5 and CaO were the dietary levels of these in grammes per 100 lb. bodyweight, has the advantages of being simple and at the same time of taking into account not only the dietary calcium-phosphorus ratio but also the absolute dietary level of phosphorus.

These relationships are shown in Figs. 1 and 2 which cover first matings and total matings (to a maximum of 3 per animal) of experimental heifers at Frant during the period August, 1951, to March, 1958. In these Figs., as in Fig. 3, the whole field is arbitrarily divided into 9 areas designated A, B, C, D, E, F, G, H, and J. The boundaries of these areas are as follows:—

Areas	*Manganese*	x_1
A, B, C	Above 100 mg. (approx.)	To the left of 0·5
		0·5 to 3·75
		To the right of 3·75

	Manganese	*Upper limit*	*Lower limit*
D, E, F	40 to 100 mg. (approx.)	To the left of 0·5	To the left of 1·0
		0·5 to 3·75	1·0 to 2·0
		To the right of 3·75	To the right of 2·0

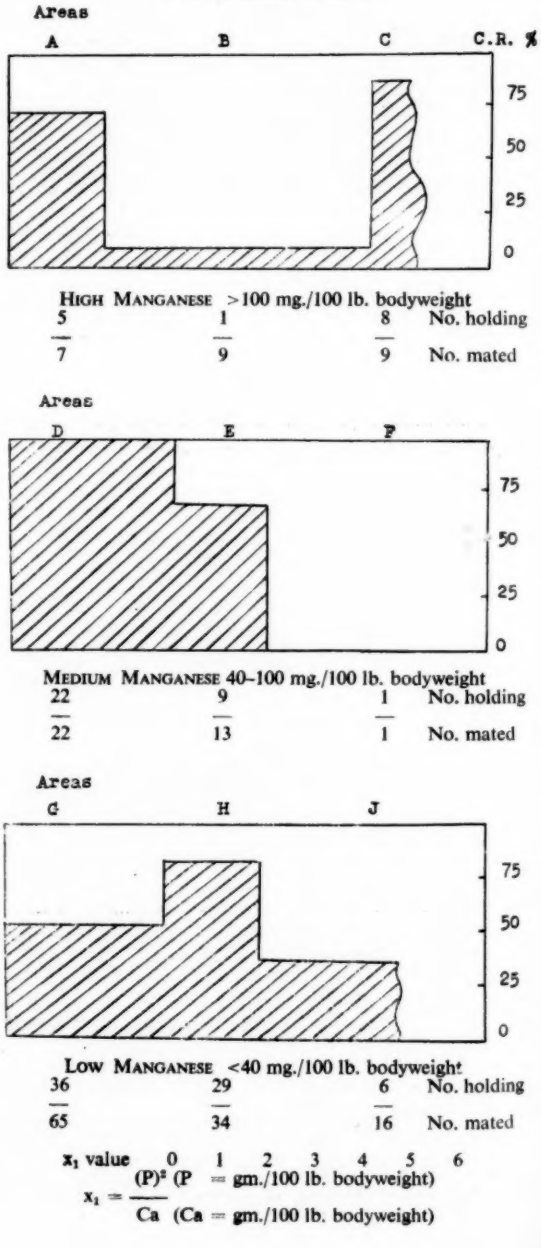
G, H, J	Less than 40 mg.	To the left of 1·0
		1·0 to 2·0
		To the right of 2·0

As already mentioned, these divisions are quite arbitrary, and have been chosen as a matter of convenience in describing what happens when given levels of calcium, phosphorus, and manganese are fed. Little information is available concerning the fertility of animals falling into area F. On the other hand, fertility in D is exceptionally high, in A, C, E, and H, quite high, in G and J fairly low, and in B very low. Throughout the time that these observations have been made, there has been no marked change in this general pattern. It is obvious that the zone of high fertility is a broad "U" or a broad "V." It would, however, be somewhat premature to attempt to define, with any degree of accuracy, its actual limits.

Areas D, E, G, and H have been dealt with in a previous publication (Hignett, 1956). A number of animals appearing in area J were then referred to as "9 animals receiving an excess of phosphorus relative to calcium." Areas A, B, and C are particularly interesting in that, as previously stated, it would appear that when calcium and phosphorus intakes are such that fertility is high, in spite of a low dietary manganese consumption, then a very high manganese intake leads to a marked depression of breeding efficiency. On the other hand, a very high

* P = grammes P per 100 lb. bodyweight; Ca = grammes Ca per 100 lb. bodyweight.

FIG. 1
EFFECT OF DIETARY CALCIUM, PHOSPHORUS AND MANGANESE LEVELS ON FERTILITY (BASED ON FIRST MATINGS) OF EXPERIMENTAL HEIFERS



manganese level is compatible with high fertility when calcium is excessive, relative to phosphorus, or vice versa.

Whilst the overall pattern of breeding performance for heifers is that shown in Figs. 1 and 2, the question

FIG. 2
EFFECT OF DIETARY CALCIUM, PHOSPHORUS AND MANGANESE LEVELS ON FERTILITY (BASED ON ALL MATINGS—MAXIMUM OF 3 PER ANIMAL) OF EXPERIMENTAL HEIFERS

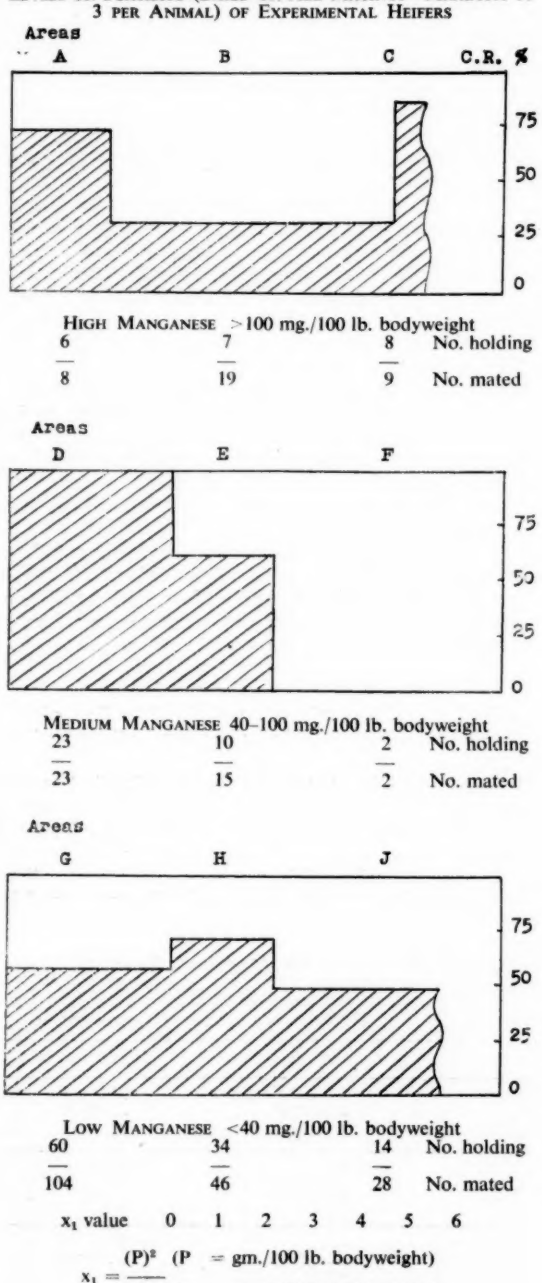
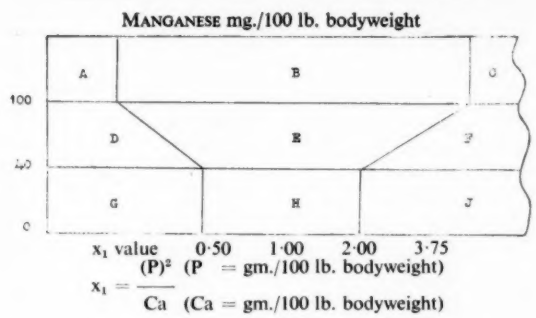


FIG. 3
LIMITS OF AREAS A, B, C, D, E, F, G, H AND J



is immediately asked, "Why do some animals in areas B, G, and J hold to a first or subsequent service?" A number of factors, apart from calcium, phosphorus, manganese, and vitamin D, have been considered to see if one or more of them influence fertility in these areas. These factors will now be discussed.

Growth Rate

As has already been said, Hignett (1956) showed that growth rate influenced fertility when heifers fell in area G. More recently, this has been confirmed for areas B and J. For animals in areas of low fertility, such as G, the critical growth rate appears to be influenced by certain undetermined environmental factors. This is illustrated in Table I, in which are shown the growth rates of all heifers in this area mated in the course of 3 series of observations made during 1953, 1954, and 1955 respectively. It will be noted that in 1954 the critical growth rate lay between 2.0 and 2.3 per cent., whereas in 1955 it was between 5.3 and 6.7 per cent. The growth rate is the live-weight gain over a period of 6 weeks—approximately 3 weeks on either side of the service date. There has been no attempt to differentiate between actual growth and deposition of fat, which both influence live-weight, although the former may have a much more important effect on the fertility of heifers in areas B, G, and J.

Lactation

Thanks to Mr. Frank Holt and to the British Oil and Cake Mills, Ltd., we have been able to make observations on the influence of dietary mineral levels on the fertility of first-calf heifers at the Bull Progeny Testing Station at Dartington Hall for the periods 1954-5, 1955-6, and 1956-7, and at both Barlby and South Cathkin for the periods 1955-6 and 1956-7. Results of the investigations point clearly to the fact that lactation has an effect similar to that of growth rate, but to a greater degree. Unfortunately, the time now available does not allow of a detailed consideration of the findings which have been discussed previously with some members of this Society.

Fertility of the Bull

Whilst the fertility of the bull undoubtedly affects the outcome of a series of matings, its influence is not necessarily the same in each of the 9 areas. It was anticipated that a bull of high fertility would

TABLE I
VARIATIONS IN EFFECT OF GROWTH RATE* ON OUTCOME OF FIRST MATINGS OF EXPERIMENTAL HEIFERS IN AREA G

1953			1954			1955		
Heifer number	Growth rate percentage	Outcome of mating	Heifer number	Growth rate percentage	Outcome of mating	Heifer number	Growth rate percentage	Outcome of mating
64	12·7	−	79	9·3	−	91	8·6	−
63	11·3	−	83	8·5	−	84	6·7	−
			80	3·4	−			
62	4·4	+	82	2·3	−	86	5·3	+
						88	2·5	+
			74	2·0	+			

* Live-weight gain during 6-week period, 3 weeks either side of service date.
− = Unsuccessful mating. + = Successful mating.

be far more successful when used on heifers with calcium, phosphorus, and manganese intakes, placing them in areas B, G, and J, than would a bull of lower fertility; whereas, in areas of high fertility it was expected that the differences would not be so marked. A careful study of available data indicates that this, in fact, might well be the case.

Every bull used for mating experimental heifers had its fertility assessed for each 4-monthly period. The bull, which on average put at least 2 out of every 3 heifers in calf to a first service during the 4-monthly period was, for that period, considered a high fertility bull: whereas, a bull which failed to attain that standard was regarded as a low fertility animal. It will be appreciated that this could well mean that during one period a bull was in the first category, and at another time in the second category.

From these observations, recorded in Table II, it is easy to see that the use of a bull of impaired fertility, on females also of impaired fertility, could immediately result in a serious herd breeding problem. Reference has already been made to Gould & Bennett's (*loc. cit.*) observations that lowered bull fertility can result from over-work. This in turn might be related to the number of females returning to service. Again, we have reason to believe that mineral intakes, which can lead to impaired breeding performance in females, can also have an adverse effect on the fertilising capacity of bull semen.

In observations made at a cattle breeding centre in 1952, 2 bulls, which during the previous 12 months had conception rates of 59 per cent. (based on 1,267 artificial inseminations) and 65 per cent. (based on 693 artificial inseminations) respectively, were given large calcium supplements (1.3 lb. chalk per day). Within 3 to 6 months, the conception rates had fallen to 33 and 39 per cent. (based on 624 and 274 artificial inseminations) respectively. Six to 10 weeks after withdrawal of the calcium supplement, the conception rates had again risen to 53 and 46 per cent. (based on 118 and 112 artificial inseminations) respectively. It is perhaps significant that only the 2 bulls receiving chalk at the centre had this low level of fertility. One of the most interesting features of this small observation was that at no time could any deterioration in semen quality be detected in the laboratory. It would thus appear that faulty feeding can influence adversely the fertilising capacity of semen before gross changes in the seminal picture are evident.

It is easy to realise that, when the rations fed to bulls, cows, and heifers on a particular farm have mineral levels likely to lead to impaired fertility, a serious breeding problem can result, even when a number of bulls are being used in the herd.

Genetical Make-up of the Heifer

With the object of seeing if the breeding of the experimental heifers had any bearing on their fertility when they were in areas B, G, and J, families were selected in which the heifers were related, but not necessarily closely related. These families were then grouped into those with a conception rate of 60 per cent. or more, based on first matings, and those with a conception rate of less than 60 per cent. The fertility of the 2 groups in areas B, G, and J, and in

TABLE II
EFFECT OF BULL FERTILITY ON THE INFLUENCE OF DIETARY CALCIUM, PHOSPHORUS AND MANGANESE LEVELS ON REPRODUCTIVE EFFICIENCY IN EXPERIMENTAL HEIFERS

Bull conception rates (1st matings)		Heifer conception rates (1st matings)	
		Areas B, G and J	Other areas
67% and over	Number of heifers holding / Number of heifers mated	32/50 (64%)	51/53 (96%)
Less than 67%	Number of heifers holding / Number of heifers mated	11/33 (33%)	22/30 (73%)
Totals	Number of heifers holding / Number of heifers mated	43/83 (52%)	73/83 (88%)

TABLE III
EFFECT OF DIETARY CALCIUM, PHOSPHORUS AND MANGANESE LEVELS ON BREEDING PERFORMANCE OF EXPERIMENTAL HEIFERS (BASED ON FIRST MATINGS) IN HIGH AND LOW FERTILITY FAMILIES

Family conception rates (1st matings)		Heifer conception rates (1st matings)	
		Areas B, G and J	Other areas
60% and over	Number of heifers holding / Number of heifers mated	22/35 (63%)	43/50 (86%)
Less than 60%	Number of heifers holding / Number of heifers mated	6/23 (26%)	10/16 (63%)
Totals	Number of heifers holding / Number of heifers mated	28/58 (48%)	53/66 (80%)

the other areas, is shown in Table III, from which it will be seen that the breeding of the heifers does appear to affect the picture. In other words, in low conception rate areas, the fertility of families with poor breeding performance is depressed to a greater extent than is that of the more fertile families.

Length of Time the Animal is on Experimental Ration

It has been suggested that the longer an experimental heifer is on a ration incompatible with high fertility, the more able she is to compensate in some way, and the greater chance there is of a successful mating. To see if this was in fact the case, the matings of experimental heifers in areas B, G, and J were grouped according to the length of time they had been on the experimental ration. The results are shown in Table IV, from which it will be seen that the passage of time itself does not appear to lead to any improvement in overall fertility. On the other hand there is a suggestion that with repeated services the conception rate tends to rise.

Meteorological Conditions

Attention has been paid to the possible effect of time of year, shade temperature, relative humidity, and barometric pressure on the fertility of experimental heifers. In no instance was there any correlation between these factors on the one hand, and reproductive efficiency on the other. This is illustrated for shade temperature, relative humidity, and barometric pressure in Tables V, VI, and VII respectively. At one time, the information available suggested that barometric pressure did have some effect on overall fertility, but this view is not supported by more recent observations. (See Tables overleaf.)

Other Nutritional Factors

This is where one really does tend to indulge in speculation.

(a) *Energy*. The view has often been expressed that the provision of high energy and/or protein is necessary for the maintenance of normal fertility in cattle. Such an impression is difficult to reconcile with the frequent observations that under-fed, thin cattle can have a high conception rate, whereas the breeding performance of those which are well fed and sleek, and often unnecessarily fat, may leave a great deal to be desired. In Tables VIII and IX, an attempt is made to correlate the starch and protein equivalents per 100 lb. bodyweight, respectively, with the fertility of experimental heifers, based on first matings. This information is provided for animals in areas B, G, and J, and for those in the other areas. It will be seen that, within these narrow ranges of carbohydrate and protein consumption, there appears

TABLE IV
EFFECT ON HEIFER FERTILITY (IN AREAS B, G AND J) OF LENGTH OF TIME EXPERIMENTAL RATION IS FED BEFORE MATING

		Length of time (in weeks) on experimental ration				
		4–6	6–8	8–10	10–12	>12
1st matings 43/90 (48%)	No. of heifers holding / No. of heifers mated	5/11 (46%)	10/25 (40%)	11/23 (48%)	8/14 (57%)	9/17 (53%)
2nd matings 27/44 (61%)	No. of heifers holding / No. of heifers mated		0/3	6/9	4/8	17/24 (71%)
3rd matings 12/15 (80%)	No. of heifers holding / No. of heifers mated			1/1	3/4	8/10
Totals 82/149 (55%)	No. of heifers holding / No. of heifers mated	5/11 (46%)	10/28 (36%)	18/33 (55%)	15/26 (58%)	34/51 (67%)

TABLE V
EFFECT OF SHADE TEMPERATURE ON FERTILITY (BASED ON 1ST MATINGS) OF EXPERIMENTAL HEIFERS

Areas		Shade temperature (° F.)				
		20–39	40–49	50–59	60–69	70–79
B, G and J 28/46 (61%)	No. of heifers holding / No. of heifers mated	9/12 (75%)	11/20 (55%)	4/7	2/4	2/3
Others 50/58 (86%)	No. of heifers holding / No. of heifers mated	15/16 (94%)	18/23 (78%)	12/12 (100%)	2/4	3/3
Totals 78/104 (75%)	No. of heifers holding / No. of heifers mated	24/28 (86%)	29/43 (76%)	16/19 (84%)	4/8	5/6

Shade temperature readings available at the time of 1st mating of only 104 experimental heifers.

TABLE VI
EFFECT OF RELATIVE HUMIDITY ON FERTILITY (BASED ON FIRST MATINGS) OF EXPERIMENTAL HEIFERS

Areas		Relative humidity (%)					
		<74	75–79	80–84	85–89	90–94	95–99
B, G and J 43/90 (48%)	No. of heifers holding / No. of heifers mated	6/10 (60%)	5/12 (42%)	6/14 (43%)	6/11 (55%)	6/12 (50%)	14/31 (45%)
Others 71/82 (87%)	No. of heifers holding / No. of heifers mated	6/10 (60%)	14/15 (93%)	5/5	13/14 (93%)	13/17 (76%)	20/21 (95%)
Totals 114/172 (66%)	No. of heifers holding / No. of heifers mated	12/20 (60%)	19/27 (70%)	11/19 (58%)	19/25 (76%)	19/29 (66%)	34/52 (65%)

No relative humidity readings available for the days heifers 52, 53, 77 and 101 were mated for the first time.

TABLE VII
EFFECT OF BAROMETRIC PRESSURE ON FERTILITY (BASED ON 1ST MATINGS) OF EXPERIMENTAL HEIFERS

Areas		Barometric pressure (ins. mercury)						
		<29·5	29·5–29·7	29·7–29·9	29·9–30·1	30·1–30·3	30·3–30·5	>30·5
B. G and J 43/90 (48%)	No. of heifers holding / No. of heifers mated	5/7	3/9	5/9	15/25 (60%)	11/26 (42%)	4/10 (40%)	0/4
Others 73/85 (86%)	No. of heifers holding / No. of heifers mated	3/3	12/13 (92%)	13/16 (81%)	9/13 (69%)	23/25 (92%)	11/13 (85%)	2/2
Totals 116/175 (66%)	No. of heifers holding / No. of heifers mated	8/10 (80%)	15/22 (68%)	18/25 (72%)	24/38 (63%)	34/51 (67%)	15/23 (65%)	2/6

No barometric pressure reading available for the day heifer 77 was mated for the first time.

to be little correlation between the plane of nutrition and breeding performance, even when animals are in low fertility areas. These results lead one to conclude that if, as they must, carbohydrates and protein play a part in breeding efficiency, then the lower critical levels are indeed low. On reflection, it would seem that the influence of a low plane of nutrition on fertility is self-limiting until, due to inanition, the animal eventually passes into a state of anoestrus. Prior to this, the lower the growth rate, the greater are the chances of the animal being mated successfully.

(b) *Magnesium.* There is reason to believe that magnesium has an effect similar to that of calcium; consequently the formula for x_1 should not be $\frac{P^2}{Ca}$ but $\frac{P^2}{Ca + Mg^*}$, the necessary adjustments being

* Mg. = grammes Mg. per 100 lb. bodyweight.

TABLE VIII
EFFECT OF STARCH EQUIVALENT PER 100 LB. BODYWEIGHT ON FERTILITY (BASED ON 1ST MATINGS) OF EXPERIMENTAL HEIFERS

Areas		Starch equivalent (lb.)			
		0·25–0·49	0·50–0·73	0·75–1·00	>1·00
B. G and J 43/90 (48%)	Number of heifers holding / Number of heifers mated	0/2	29/56 (52%)	14/31 (45%)	0/1
Others 74/86 (86%)	Number of heifers holding / Number of heifers mated		38/44 (86%)	26/31 (84%)	10/11 (91%)
Totals 117/176 (66%)	Number of heifers holding / Number of heifers mated	0/2	67/100	40/62 (65%)	10/12 (83%)

TABLE IX
EFFECT OF PROTEIN EQUIVALENT PER 100 LB. BODYWEIGHT ON FERTILITY (BASED ON 1ST MATINGS) OF EXPERIMENTAL HEIFERS

Areas		Protein equivalent (lb.)			
		<0·11	0·11–0·13	0·14–0·16	>0·16
B, G and J 43/90 (48%)	Number of heifers holding / Number of heifers mated	8/20 (40%)	28/55 (51%)	7/13 (54%)	0/2
Others 74/86 (86%)	Number of heifers holding / Number of heifers mated	2/2	37/41 (90%)	27/33 (82%)	8/10
Totals 117/176 (66%)	Number of heifers holding / Number of heifers mated	10/22 (45%)	65/96 (68%)	34/46 (74%)	8/12 (67%)

made for molecular equivalents. The influence of magnesium has been minimal in our heifer experiments, because the intake of elemental magnesium has been only 0.7 g. to 3.5 g. per 100 lb. bodyweight, compared with a range of 5.8 g. to 17.7 g. per 100 lb. bodyweight for calcium. On the other hand, under farm conditions, particularly in the Tropics, the consumption of magnesium can be quite high and, presumably, can have a profound effect on fertility. In addition to magnesium being complementary to calcium, it might also have an effect similar to that of manganese. Thus, infertility due to low dietary manganese levels could possibly be corrected by feeding adequate amounts of magnesium.

(c) *Sodium and Potassium.* Attempts to correlate dietary levels of sodium and potassium with the fertility of experimental heifers have proved inconclusive. Nevertheless, it is possible that these two elements play some part in the reproductive mechanism. Certainly, feeding experiments and field results at least suggest that potassium, rather surprisingly, has the same effect as phosphorus. It is worth bearing in mind that chemical analysis at Frant, of feeding-stuffs, including pasture herbage, shows that fluctuations in levels of potassium, *i.e.* 0.8 to 5.1 per cent. on a dry matter basis, are of the same order as those for calcium and phosphorus which are second only to the range for manganese, *i.e.* 0.001 to 0.112 per cent.

(d) *Iron.* Ford (1955) has drawn attention to the possible interference by iron in the utilisation of certain trace elements, including manganese. In an attempt to confirm this view, ferrous sulphate was fed at the rate of 2 g. per 100 lb. bodyweight, daily to 3 heifers for 13 to 26 weeks. The calcium, phosphorus, and manganese intakes were originally adjusted to place animals in area G. All heifers held to a first service. However, it was subsequently discovered that even B.P. ferrous sulphate, as used in this experiment, contains an appreciable level of manganese, and this had not been taken into account.

(e) *Sulphate.* Inorganic sulphate, as judged by data collected from feeding experiments and from field observations, might well have an effect similar to that of phosphorus. In other words, an animal which according to manganese intakes and the dietary calcium-phosphorus status, falls in group G or H, might behave like one in H or J respectively, if inorganic sulphate were high.

(f) *Chloride.* The effect of the chloride ion on bovine fertility is not known, although by analogy with inorganic sulphate one might expect the effect to be similar to that of phosphorus.

(g) *Nitrogen.* Field observations point clearly to the fact that high crude protein consumption has the same effect on bovine fertility as high phosphorus.

(h) *Carotene.* It was observed by Dr. Ruth Allcroft that experimental cows at Frant receiving a ration with high phosphorus relative to calcium, tended to have lower blood carotene values than those for other animals fed similarly, but with the calcium exceeding phosphorus. In 1954 blood samples were examined from 18 heifers being used

TABLE X
APPARENT RELATIONSHIP OF BLOOD CAROTENE VALUES TO (A) DIETARY CALCIUM AND PHOSPHORUS LEVELS AND (B) FERTILITY (BASED ON 1ST MATINGS) OF EXPERIMENTAL HEIFERS IN AREAS G, H AND J

Group		Blood carotene (μg. %)	
		Less than 30	30 and over
CaO > P_2O_5	No. of heifers holding	1	7
	No. of heifers mated	2	7
P_2O_5 > CaO	No. of heifers holding	0	3
	No. of heifers mated	6	3

for a feeding experiment in which the 3 areas G, H, and J were represented. They showed that after being on the experimental ration for 18 weeks, only 3 out of 9 animals receiving excess phosphorus had blood carotene values of 30 μg. per cent. or over. On the other hand, of the heifers receiving more calcium, in terms of CaO, than phosphorus, in terms of P_2O_5, 7 out of 9 had blood carotene values of 30 μg. per cent. or over. It thus appeared that the high phosphorus relative to calcium interfered with the utilisation of carotene in heifers, all of which were receiving a liberal vitamin A supplement. Perhaps even more interesting was the fact that 10 out of 10 of the heifers with blood carotene values of 30 μg. per cent. and over held to a first mating, whereas only 1 out of the remaining 8 did so. These observations are illustrated in Table X. Sad to relate, it has not been possible to show similar differences in blood carotene values which can be related to dietary calcium and phosphorus levels, in animals used for subsequent feeding experiments. Furthermore, many heifers on the experimental rations have had blood carotene values of less than 30 μg. per cent., and have bred normally.

Findings of this sort, which are made not infrequently, are no doubt of the greatest possible significance, even if the observations cannot be repeated immediately. The longer the experience, the more it is appreciated that such results merely challenge one to make further efforts to determine the environmental factors involved.

*p*H of Rumen Contents

It was considered possible that the effect of different mineral intakes might be related to the influence of these ions on rumenal *p*H. To cover this possibility nearly 200 rumen samples were collected by stomach tube from cows and heifers, the majority of these taken about 4 hours after feeding. A careful study of the data collected fails to show a close correlation between dietary mineral levels and rumen *p*H, and no correlation between rumen *p*H and fertility.

Hereditary Defects and Infective Agents

When considering the various factors which may influence the part played by nutrition in the reproductive process, it should be borne in mind that nutrition itself may affect the importance of hereditary defects and/or infective agents which, themselves, may lead to impaired fertility. In this connexion Hignett (1953) presented evidence suggesting that a nutritional disturbance conditioned an hereditary defect, in this case adrenal virilism, and precipitated a very high incidence of this reproductive disorder in cattle in Antigua.

As far as infection is concerned, Hignett and Kelly (1944, unpublished data) obtained evidence to support the view that feeding could influence the susceptibility of cattle to experimental infection with *Trichomonas foetus*. More recently, observations at the Wellcome Veterinary Research Station (Hignett & Pitfield, 1958) indicate that dietary calcium and phosphorus levels can affect the response when a culture of *Corynebacterium pyogenes* is injected into the uterus. In this second experiment, an attempt has been made to determine the value of *C. pyogenes* vaccine for protection against, and the effect of calcium and phosphorus on the susceptibility to, corynebacterial infection of the endometrium. Four experimental cows were run with the herd, 2 receiving a course of 3 injections (of 10, 15, and 20 ml. respectively) of a commercial killed *C. pyogenes* vaccine given at intervals of one month, while 2 animals were left as untreated controls. Then, when a corpus luteum was present, each of the 4 animals was given an intra-uterine injection of 1 ml. of a suspension of *C. pyogenes* containing 10^8 organisms. Each animal was slaughtered 5 days later and the uterus recovered and examined bacteriologically, and for the presence of pus. Subsequently, non-lactating experimental cows were housed and fed rations of ground nut cake, sugar beet pulp, and oat straw, providing a total daily intake of 7.6 lb. starch equivalent and 0.9 lb. protein equivalent per animal.

TABLE XI
THE EFFICIENCY OF IMMUNISATION AGAINST *C. pyogenes* PYOMETRA IN COWS AND POSSIBLE EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON SUSCEPTIBILITY TO THIS INFECTION

Feeding	Immunised cows		Control cows	
	Number developing pyometra	Number not infected	Number developing pyometra	Number not infected
No special attention to feeding ...	0	2	2	0
High calcium	1	3	2	1
Calcium and phosphorus balanced ...	0	2	3	1
High phosphorus	4	0	4	0
Totals	5	7	11	2

TABLE XII
EFFECT OF IMMUNISATION AND OF DIETARY CALCIUM AND PHOSPHORUS ON THE SEVERITY OF CORYNEBACTERIAL PYOMETRA IN COWS

Feeding	Immunised cows					Control cows				
	Degree of pyometra									
	−	+	++	+++	++++	−	+	++	+++	++++
No special attention to feeding ...	2							1	1	
High calcium	3		1			1		1		1
Calcium and phosphorus balanced	2					1	1	1	1	
High phosphorus		1	2		1				1	3
Totals	7	1	3		1	2	1	3	3	4

− = Uterus normal at *post-mortem* examination.
+ = Flakes of pus only, in one or both uterine horns.
++ = Pus in horns and body of uterus.
+++ = Pus and mucus in horns and body of uterus.
++++ = Pus and mucus in horns and body of uterus and animal actually discharging before slaughter.

By the use of calcium and phosphorus supplements, the animals were divided into those receiving a ration with excess calcium relative to phosphorus, those receiving a ration in which calcium and phosphorus were well balanced, and those receiving a ration in which phosphorus was in excess relative to calcium. All animals were given the ration for 13 weeks; those vaccinated, receiving their first injection 4 weeks from the beginning of the experiment. Again, all animals were challenged with *C. pyogenes* culture intra-uteri when corpora lutea were present, slaughtered 7 to 11 days later, and examined as before. The results to date are summarised in Tables XI and XII, from which it can be seen that dietary calcium and phosphorus levels appear to have an effect, not only on susceptibility to corynebacterial infection, but also on the value of *C. pyogenes* vaccine. In these results, high phosphorus relative to calcium appears to render animals particularly susceptible to corynebacterial infection of the uterus. This is completely in keeping with our field observations, to which frequent references have been made in the past.

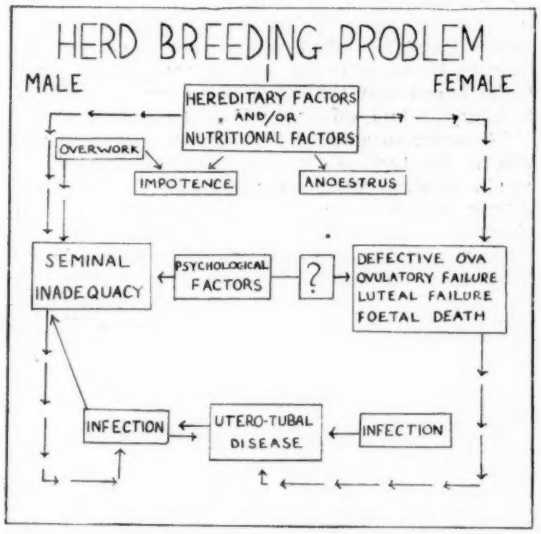
Conclusion

In this paper an attempt is made to establish that dietary mineral levels can influence the fertility of cattle. Their effect is determined to a large extent by other considerations, such as the fertility of the bull, the genetical make-up of the females, growth rate, milk yield and the amount of exercise taken (field observations suggest that forced exercise has the same impact as growth rate and lactation), and also by certain infectious agents which may be present. It is abundantly clear that dietary levels of certain minerals, compatible with satisfactory fertility at one time, would aggravate the breeding problem at another; furthermore, it must be remembered that, in this dissertation, attention has been paid to a very limited range of nutritional factors. There are perhaps other constituents of the ration which can have a greater influence on the breeding performance of cattle. Unpublished work at the Wellcome Veterinary Research Station shows that the utilisation of iodine is affected, similarly to that of manganese, by different dietary levels of the major mineral elements. It may well be that these major minerals also influence an animal's ability to make use of other trace elements. That this happens in the case of zinc has already been demonstrated by Tucker and Salmon (1955) in connexion with their work on parakeratosis in pigs.

From a consideration of the minerals involved, it would not be unreasonable to expect that their influence on certain enzyme systems may affect reproductive efficiency. Attention to the part played by these enzyme systems may well be exceedingly profitable.

Herd breeding problems due to deficiencies or imbalances are most frequently encountered in highly productive herds, on farms where a full measure of self-sufficiency is practised. This is no doubt related, not only to high milk production, but also to the fact that self-sufficiency means a greater dependence throughout the year on leafy grass and forage crops, fresh or conserved. It is the leaf which reflects the

FIG. 4.



(*Concluded at the foot of page* 256)

Experiments on the Cause of Hypomagnesaemic Tetany in Calves

BY

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SUMMARY.—(i) *Experiments were carried out to investigate the effect of hypomagnesaemia on the cholinesterase enzyme system of calves.*

(ii) *Blood cholinesterase was apparently not affected by hypomagnesaemia.*

(iii) *Calves suffering from hypomagnesaemia were not markedly more susceptible to the effects of an anti-cholinesterase drug (physostigmine salicylate).*

Introduction

TETANY in calves associated with a low level of magnesium in the blood serum has been known for more than 20 years. By rearing calves for long periods on milk alone or milk plus special supplements Duncan, Huffman and Robinson (1935) produced serum magnesium levels down to one-tenth of the normal, and found that hyper-excitability, tetany and convulsions ensued. Milk is comparatively low in magnesium, and Blaxter & Sharman (1955) found hypomagnesaemia in beef calves under farm conditions in the North of Scotland, resulting in some cases in tetany and death. The condition occurs during the first 3 months of life while the calves are suckling their mothers, and before they go out to grass in the spring.

Thomas & Okamoto (1953), Blaxter, Rook and MacDonald (1954) reproduced the condition using synthetic milk diets low in magnesium, and recorded clinical symptoms similar to those found by Duncan, Huffman & Robinson (1935) but *post-mortem* histological examination revealed no calcification as found by the earlier workers.

As severe hypomagnesaemia can persist for a number of days or even weeks without clinical symptoms appearing, there cannot be a direct relationship between the two. Halse (1948) found that in dairy cows developing hypomagnesaemia, blood phosphatase was positively correlated with serum magnesium. Though supplementary magnesium relieved

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Some Nutritional and Other Inter-acting Factors which may Influence the Fertility of Cattle—*Concluded.*

mineral status of the soil (as has been pointed out by Underwood, 1957), the seeds and roots usually having a much more consistent level of the various minerals.

The author and his colleagues are well aware of the fact that the number of experimental heifers used for tests on which deductions are based, is small; this is inevitable when such detailed investigations have to be made in the case of each heifer. It is to be hoped that the attention to detail will itself, to a large extent, off-set the lack of numbers.

We make no apology for emphasising once again that in the type of observation here recorded, the results obtained under one set of environmental conditions can be very different from those existing elsewhere. The time has surely arrived when it is obvious that the true position of nutrition in the story of reproductive efficiency in cattle can only be assessed by numerous feeding experiments undertaken at different centres and, more especially, by carefully planned fundamental work to determine the way in which various constituents of the ration, singly or combined, influence the metabolism of the individual animal.

Finally, it is with some satisfaction that we can look back to our earlier observations and realise that in spite of amassing much further information, we have not had to modify our deductions to any material extent. In this connexion may we refer you to a diagram, originally produced in 1949 by our former colleague, Dr. J. L. Hancock, and shown in Fig. 4. It seems to us that it illustrates as well now, as then, our views on the way in which heredity, infection, management, and nutrition can contribute to the herd breeding problem, and on the way in which these factors are inter-related.

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the hypomagnesaemia, it had little effect on the phosphatase activity, so he concluded that the two were not related. Because of the fact that some of the clinical signs of hypomagnesaemia are similar to those of vitamin B_1 deficiency in other species, Blaxter & Rook (1954) considered the possibility of a connexion between the conditions, but since their experiments showed that the increases in blood lactate and pyruvate found during tetany and convulsions could be accounted for entirely by increased production due to muscular activity, they concluded that vitamin B_1 was not involved in clinical hypomagnesaemia. These observations were confirmed by Parr (1957).

The results of these investigations suggested that the clinical manifestations of hypomagnesaemia were not associated with tissue reactions, and disturbance of the neuro-muscular transmission seemed more likely. Del Castillo & Engbaek (1953) studied the role of magnesium in excitation of the frog sartorius muscle, and found that magnesium raises the electric threshold of the muscle membrane, so that a greater end-plate potential is required to produce contraction. If the converse of this were true then hypomagnesaemic tetany in ruminants would be explained by a lowered electric threshold resulting in repeated muscular contractions. This does not, however, account for all the known facts, for del Castillo & Stark (1952) found an antagonism between calcium and magnesium at the neuro-muscular junction which would appear to be at variance with the fact that hypocalcaemia is very often concomitant with hypomagnesaemia when clinical symptoms appear (Breirem, Ender, Halse & Slagsvold, 1949 ; Allcroft 1947 ; Parr, 1957). If the above were true, then a lowered serum calcium would tend to counteract the effects of low serum magnesium, rather than precipitate the clinical symptoms.

An alternative interpretation of del Castillo & Engbaek's results, as proposed by Blaxter & Rook (1954) is that magnesium deficiency affects the activity of acetyl cholinesterase or choline acetylase, and they report that magnesium-deficient calves are very sensitive to anti-cholinesterase drugs. The experiments reported below were carried out to determine the effect of hypomagnesaemia on the cholinesterase enzyme system.

Production of low-magnesium milk

In earlier studies where rations of low magnesium content were required, synthetic or semi-synthetic milks were made in the laboratory. In these experiments either whole or skim milk was used from which one-third to one-half of the magnesium was effectively removed by treatment with an ion exchange resin. Zeokarb 225, at the rate of 250 g. to 300 g. per gallon, was added to the milk and stirred or agitated briskly for 15 to 20 minutes and the milk poured off, after allowing the resin to settle. As the resin removes calcium and the trace elements as well as magnesium, 4 g. calcium hydroxide and 5 ml. of trace element solution (0·4 g. ferric citrate, 0·02 g. manganese sulphate, 0·1 g. copper sulphate, 0·2 g. zinc sulphate and 0·1 g. cobalt chloride per litre) were added per litre of milk treated. As the sodium form of the resin was used, the resulting milk was thus lower in magnesium and higher in sodium content than the original. Tests of the efficiency of extraction were carried out by titrating the milk, before and after resin treatment, with ethylenediamine-tetra-acetic acid (E.D.T.A.). The procedure was as follows : 1 ml. of 3N ammonium hydroxide and 2 drops of Eriochrome Black indicator were added to 1 ml. of milk and titrated with 0·015M E.D.T.A. (NH_4 salt) to a pure blue end-point. Examples of the results obtained are given in Table I.

TABLE I
EFFICIENCY OF EXTRACTION OF BIVALENT METALS FROM MILK

Milk (gal.)	Resin (g.)	Titration (ml. 0·015M E.D.T.A.)	
		Before	After
3	800	2·65	1·40
3	800	2·55	1·38
2	600	2·60	1·40

The resin was then washed free of milk with tap water and transferred to a large glass column where it was regenerated by percolating 5 per cent. sodium chloride alone or 2N hydrochloride acid followed by sodium chloride. When hydrochloric acid is used, thorough washing with distilled water is necessary since residual acidity in the resin is liable to cause precipitation of casein on treating the next batch of milk.

Management

Calves were housed in pairs and bedded on sawdust which had a magnesium content of 0·02 per cent., so that, if they did eat any of it, the magnesium content would be almost negligible. They received whole milk alone or skim milk plus vitaminised margarine as their sole ration during the experiments. Each received its dam's colostrum and remained on whole milk for the first week of life. Experimental rations were gradually introduced during the second week, and during the third week each calf was receiving 6 litres of its ration, in 2 feeds daily. The ration was increased by 1 litre per week to 10 litres and thereafter remained constant. The calves were bled at weekly intervals or more frequently when required, and they were also weighed each week.

Analytical Methods

Serum calcium and magnesium were estimated by a modification of the method of Friedman & Robin (1955) which is based on direct titration of the serum with E.D.T.A. using Eriochrome Black indicator (Todd, 1958). Since the blood cholinesterase levels of animals can drop to one-tenth of the normal without clinical symptoms appearing, gross changes would be expected, so the field method of Edson (1955), as modified by Jolly & Ratcliffe (1958) was considered to be sufficiently accurate. Magnesium estimations in milk were carried out by digesting 5 ml. milk with 2 ml. nitric acid and 2 ml. perchloric acid, diluting to 100 ml., and using 1 ml. or 2 ml. aliquots for colorimetric estimation by the Titan Yellow method of

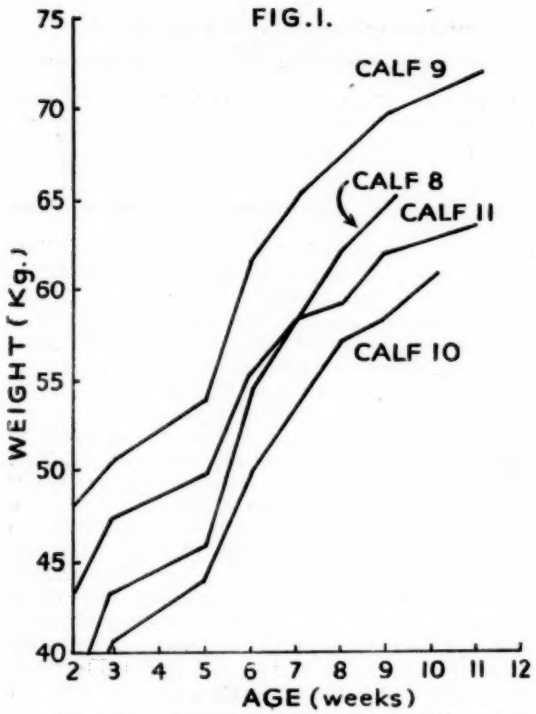

FIG. 1. Growth rates of calves during experiment.

Mason (1951). A similar method was used for sawdust and bedding materials, using 0·5 g. of the dried material.

Experiment 1

Layout : Four Ayrshire bull calves were used, 2 of them (Nos. 8 & 9) receiving skim milk and 2 (Nos. 10 & 11) receiving treated (*i.e.* low-magnesium) skim milk. In addition, each calf received 50 g. vitaminised margarine with each feed. Live-weight, serum calcium and magnesium were determined throughout the experiment, and from the 7th week onwards blood cholinesterase levels were estimated at weekly or twice-weekly intervals. Analysis of each batch of milk for magnesium content was carried out before and after treatment, so that the daily intake of magnesium could be calculated. The experiment was stopped when the surviving calves were 11½ weeks old.

TABLE II
AVERAGE DAILY MAGNESIUM INTAKE OF CALVES

Age in weeks	Average daily mg. intake in mg.	
	Numbers 8 and 9	Numbers 10 and 11
2—3	740	400
3—4	990	560
4—5	930	620
5—6	990	800
6—7	1,160	820
7—8	1,120	660
8—9	1,160	640
9—10	1,180	660
10—11	1,120	720
11—end	1,040	700

Results : In general the calves took their rations readily, and, except for a scour which affected calves 10 and 11 for almost a week when they were 6 weeks old, health and growth rates were satisfactory throughout the experiment (Fig. 1). Table 2 shows the average daily intake of magnesium of the two groups.

The magnesium content of the untreated skim milk ration averaged 0·11 per cent. Mg., and that of the treated ration 0·06 per cent. on a dry matter basis. Blaxter & Sharman (1955) estimated the daily requirement of the calf to be at least 1,400 mg. Mg. so that neither of the rations provided sufficient of this mineral, although the untreated ration was only slightly deficient. The serum magnesium results are presented in Fig. 2 and confirm that none of the calves was receiving an adequate supply. Calves 8 and 9, on the untreated milk, did not develop as low levels as calves 10 and 11 on the treated milk, but calf No. 8 was the first one to die. It was found dead one morning without previously having shown any of the clinical signs of hypomagnesaemia. Three days previously its serum magnesium level had been 1·04 mg. per 100 ml. and had been falling steeply over the previous week. *Post-mortem* examination showed nothing inconsistent with a diagnosis of hypomagnesaemia as the cause of death.

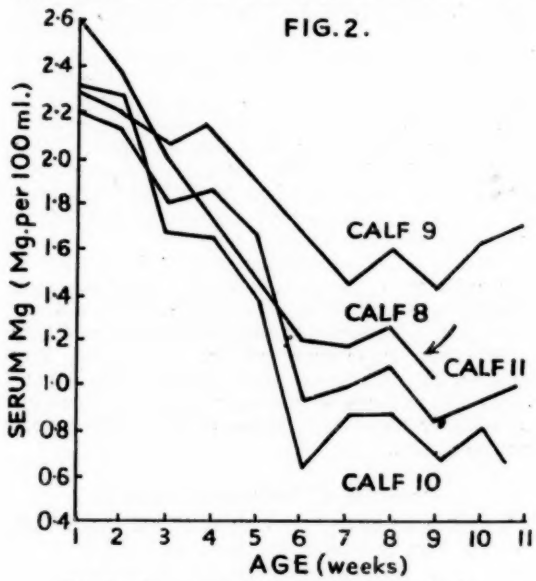

FIG. 2. Serum magnesium levels of calves during experiment.

Eight days later calf No. 10 died following typical symptoms. It did not take its milk well in the morning and during the fore-noon typical hypersensitivity developed. Blood samples were taken and in the afternoon clinical symptoms were so marked that it was decided to record them on cine-film. On taking the calf from its pen, it went into tetany and convulsions : 5 mg. atropine sulphate were given intramuscularly and 15 ml. of 40 per cent. calcium boro-

gluconate intravenously, but failed to elicit any response and the calf died some 20 minutes later. As with calf No. 8, *post-mortem* examination was consistent with hypomagnesaemia as reported by Blaxter & Rook (1954).

In calves 9 and 11 symptoms of hypomagnesaemia were not observed at any time, even though No. 11 had a blood serum magnesium level of less than 1·0 mg. per 100 ml. for a considerable period.

The blood serum calcium results are not given in detail but are summarised in Table III. No marked hypocalcaemia was found at any time. Calf No. 8 had a level of 9·66 mg. per 100 ml. at the last sampling before death, and calf No. 10 had 9·15 mg. calcium in its serum when clinical symptoms were evident a few hours before death.

TABLE III

	Serum Calcium (Mg. per 100 ml.)	
	Range	Average
Calf Number 8	9·09 to 11·40	10·1
,, ,, 9	8·40 ,, 11·79	9·7
,, ,, 10	7·11 ,, 12·00	10·0
,, ,, 11	8·28 ,, 10·92	9·5

The results of the cholinesterase estimations on heparinised blood samples are given in Table IV. Three days before death the blood cholinesterase level of Calf No. 8 had shown a sharp drop to 75 per cent. of the normal, and it was thought that before death the level might have been very low. This was apparently not the case, as Calf No. 10 showed a normal level throughout, the last sample being taken when clinical symptoms were marked, a few hours before death. No explanation is offered for the low values recorded for Calf No. 11 in the earlier samples, and there was a spontaneous recovery to normal values by the end of the experiment. A careful watch was kept on this calf at this period, but no signs of a clinical reaction were seen at any time.

TABLE IV
BLOOD CHOLINESTERASE LEVELS OF CALVES (PER CENT OF NORMAL LEVEL)

Age of calf (weeks)	Number 8	Number 9	Number 10	Number 11
7	95	90	90	55
8	100	90	100	65
9	75	90	100	75
9½	—*	100	90	75
10	—	100	100	70
10½	—	100	90	100
10½	—	—	100*	—

*Died.

These figures indicate that there is no lowering of blood cholinesterase during the period of reduced serum magnesium levels, but it is still possible that there could be a reduction in the amount of enzyme surrounding the neuro-muscular junctions. Wright (1947) states that the enzyme is concentrated round the motor nerve ending rather than being evenly distributed throughout the tissues and body fluids. Presumably it is possible therefore for that concentration to be reduced without a concurrent fall in the blood level.

Experiment 2

In an attempt to elucidate this point further it was decided to experiment with an anti-cholinesterase drug which would have its action around the motor nerve endings. Blaxter & Rook (1954) have stated that hypomagnesaemic calves are much more sensitive to these drugs than are normal animals. Physostigmine salicylate was used for the purpose and it was administered in solution intravenously.

In the normal animal the drug inhibits the enzyme's action of destroying acetylcholine, and in consequence there is produced a state of prolonged acetylcholine activity at the neuromuscular junctions following each stimulation of motor nerves. This creates a short tetanic spasm in skeletal muscle in response to each nerve stimulation where without the drug there would be only 1 twitch. In muscles supplied by cranial and sacral autonomic nerves, physostigmine produces the equivalent of excessive stimulation in the same way as it does in skeletal musculature. There is produced bronchial constriction, reduction of cardiac activity, intestinal constriction and contraction of other smooth muscles supplied by the parasympathetic system.

Physostigmine salicylate solution (1 mg. per ml.) was administered to 2 normal calves in order to establish what dosage rate produced a visible but minimal effect on the musculature of the animals.

The calves were between 2 and 3 weeks old at the commencement of the work and were being fed on whole milk, which was later supplemented with hay and calf nuts. Each calf was injected at intervals of about 1 week for 10 weeks. Prior to the injection of physostigmine each was weighed and a sample of blood taken for magnesium estimation. The serum magnesium level in these 2 calves remained between 2·3 and 2·5 mg. per 100 ml. throughout the period of experiment. At first, when excessive doses of the drug were used there were signs of spasm in all skeletal and cutaneous muscle, great salivation with tongue and jaw movements, considerable abdominal pain and difficult and noisy breathing. It was necessary to reverse the reaction with atropine given intramuscularly or subcutaneously at a rate of 5 mg. per injection.

Eventually it was found that doses of 0·05 to 0·06 mg. of physostigmine salicylate per lb. bodyweight produced the desired effect of slight twitching of the cutaneous muscles over the shoulder, chest and flank together with a fairly constantly-noted stiffening of the muscles of the quarters and a straightening of the hocks. These effects passed off in 5 to 10 minutes without the administration of any atropine, and the calves became quite normal thereafter.

Two calves fed on synthetic low magnesium diets were then used for the injections with the same pre-injection routine of weighing and bleeding for serum magnesium tests. The same dosage rates per lb. produced similar minimal muscular responses when the serum magnesium was at levels of 1·0 to 1·5 mg.

per 100 ml. Lower dosage rates of 0·04 mg. per lb. bodyweight produced little or no muscular twitching. When the serum magnesium level fell to less than 1.0 mg. the effect of the drug was not more marked but it was more prolonged on some occasions, but not on all occasions. Reduced dosage rates again did not produce any effect.

In 1 calf (No. 4) the serum magnesium level was temporarily raised from 0·63 to 0·93 mg. per 100 ml. by administering magnesium sulphate intravenously. Injections of similar doses of physostigmine before and after raising the magnesium level produced responses which did not differ in any respect from each other.

These findings are consistent with those in Experiment 1 in which there was found to be no reduction in blood cholinesterase either during non-clinical hypomagnesaemia or during the terminal stages of the condition when clinical symptoms were very marked. This is supported by the fact that calf No. 10 failed to respond to atropine sulphate administered 20 to 30 minutes prior to its death.

Conclusions

We were unable to demonstrate that hypomagnesaemic calves are much more sensitive to an anticholinesterase drug than are calves with normal blood magnesium levels.

Our results do not indicate that there is any reduction in blood cholinesterase or in the cholinesterase concentration at the neuromuscular junction during hypomagnesaemia.

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Foreign Diseases and the Inspection and Quarantine of Imported Animals*

BY

L. C. HEEMSTRA

Director, Animal Inspection and Quarantine Division, Agricultural Research Service, U.S. Department of Agriculture.

WE seem to be in greater danger to-day than ever before from the threat of foreign animal diseases. The great increase in world-wide travel by the people of all nations, the expanding movements of animals and products from country to country, and the speed with which this is done in modern times, have added to the risk. Thus it is imperative that we continue to give serious attention to the international aspects of animal disease control.

We recognise, of course, that much can be gained through international co-operative efforts by advancement of knowledge of animal diseases and methods of suppressing them. These things cannot help but benefit all nations. Nevertheless, it would seem significant that if we are to make substantial progress, each nation must first accept individual responsibility in controlling animal diseases within its borders and in providing protection against those from without. Each nation must also do this in a manner considered best by those having such national responsibility.

We, like all nations, are plagued by many infectious and communicable diseases in our livestock and our poultry. Some are well established and each year exact a toll in deaths, disability, and loss of production. Some diseases once considered serious maladies in the United States have been eradicated. Others, such as brucellosis and tuberculosis in cattle, scrapie in sheep, hog cholera in swine, pullorum disease and typhoid in poultry, we are now endeavouring to eradicate. Some diseases we have learned to live with although it is traditionally our policy not to tolerate a disease if we can do something about getting rid of it.

Foot-and-mouth disease is no stranger to us. We have experienced 9 outbreaks of this most dreaded of all animal diseases. It has not appeared in the United States since 1929. We have been fortunate but we have also worked diligently in maintaining our freedom from this disease.

These things are mentioned only to show that our problem in disease control and eradication would be compounded many times if foreign diseases were to gain entrance and become established.

There are many diseases affecting all species of animals throughout the world. They may vary from those producing only slight illness to those causing extremely high mortality. Some may affect man. Some are constantly present in various areas of the world ; others appear only sporadically. All are capable of being transmitted from one part of the world to another.

*Paper presented to the British Caribbean Veterinary Conference, 1958.

In the past we have looked upon the incidence of a number of animal diseases as problems peculiar to the countries or areas of the world where they happened to be. We have often not thought it necessary to be greatly concerned over such diseases because of what we consider to be a favourable geographic position from the standpoint of introduction. But we can no longer condone such complacency. The build-up in international trade and travel, air transportation, and much faster surface vessels, have added new importance to the problems associated with foreign animal diseases.

We have also placed considerable reliance in what was regarded as an effective travel-time margin of safety against foreign diseases. Animals infected with a communicable disease at about the time of shipment from a foreign country had time to develop symptoms of most of them while in transit, but with air transportation we do not have this advantage. Travel time may be much faster than the incubation period of a disease.

Even though rigid and effective precautions are constantly in operation, there still remains, and always will remain, the possibility that some diseases may gain entrance. The risk of accidental introduction is very great indeed.

Regulations Governing the Importation of Animals into the United States

The question may well be asked as to why certain importations of animals and products, if they represent a hazard, are permitted at all. In the United States, the Congress can by specific legislation prohibit the entry of certain animals and products from certain countries when this is considered necessary as a matter of protection against diseases. In the absence of such specific legislation, we have no authority to prohibit entry. We must then by restrictions under regulations seek the protection which is necessary.

It is believed that all at this meeting are familiar with the provisions of a federal statute relating to the importation of domestic ruminants and swine from countries in which foot-and-mouth disease or rinderpest exists. This statute requires the Secretary of Agriculture to determine the existence or nonexistence of these diseases in all foreign countries. When he has determined that either disease exists in a country, he gives public notice thereof and, until such time as in like manner he determines that the diseases no longer exist in a country, the importation into the United States of cattle, sheep, other domestic ruminants and swine, is prohibited. The same prohibition is applicable to the importation of fresh, chilled, or frozen meats from such animals. To carry out the provisions of this statute, the Department maintains on a current basis a list of foot-and-mouth disease or rinderpest-infected countries.

A question has been raised at this meeting as to the position of the United States in regard to the importation of semen from infected countries. Studies have shown that the virus of foot-and mouth disease may be contained in the semen of bulls infected with the disease. There are as yet no known procedure or techniques which would render semen safe from the hazard of foot-and-mouth disease contamination, should any virus be present in the semen at the time of collection. The deep-freeze technique now employed in the storage and transportation of semen would actually preserve the virus. Semen is a living product intended for direct use in susceptible animals. Accordingly, we must consider semen to be in the same category as the donor animal. If the donor animal is prohibited entry, the semen is likewise prohibited.

The legislation previously referred to which prohibits the importation of domestic ruminants and swine from countries where foot-and-mouth disease or rinderpest exists does not extend to wild ruminants and swine which are also susceptible to these diseases. Wild ruminants may be equally dangerous as carrier animals, even though they themselves show no evidence of the diseases. Under other authority, however, we have succeeded in regulating the importation of wild ruminants so as to avoid introduction of foot-and-mouth disease and rinderpest into this country. This has included careful examination of all circumstances involved in each proposed importation before the issuance of an importation permit, and the application of rigid inspection and quarantine measures which limit the distribution of imported wild animals for maintenance under post-entry restrictions to zoos previously approved by the Department.

In providing protection against foreign diseases by means of imported animals, much value may be attached to the issuance of permits before the animals are shipped from the country of origin. Permits would be of little value if they were only for purposes of recording intended importations. The purpose of permits is to administer more effectively the provisions of the laws and regulations relating to exposure to diseases in the country of origin. Thus such factors as the prevalence of diseases, veterinary services, and quarantine practices are all considered. Permits also allow regulatory officials to specify conditions under which importations may be made.

With few exceptions, animals intended for importation should be accompanied by an appropriate certificate of health issued by responsible veterinary officials in the country of origin. Certificates of health, however, are not in themselves adequate assurance against the introduction of diseases. In the first place, the incubation period of a disease may allow a potentially dangerous carrier animal showing no evidence of disease to be shipped from a foreign country under a certificate of health appropriately issued at the time of shipment. Secondly, certificates of health in some cases may be in error because of inability to obtain complete knowledge as to local disease conditions.

Inspection at Ports of Entry

To provide for the orderly importation of animals and poultry, the principal coastal cities and various points along our intentional land borders have been designated as ports of entry. At some of these ports the Division maintains resident veterinarians, while

at others veterinary inspection services are provided on an appointment basis.

Health inspection of imported animals and poultry is mandatory by law. When offered for entry, careful physical examination is made and accompanying documents and test charts are checked. Animals not meeting the requirements upon initial inspection are refused entry and either sent back or destroyed. Those potentially eligible for entry may be held for quarantine, or other detention.

Quarantine of imported animals at ports of entry is considered extremely important in preventing the introduction of foreign animal diseases. Adequate quarantine has taken on added significance with the increased use of air transportation. For example, a recent shipment of game birds, apparently healthy when loaded aboard the transporting aircraft, developed symptoms of Newcastle disease after a few days in quarantine. The strain isolated proved to be a highly lethal type.

The matter of providing facilities for adequate quarantine varies from country to country. In the United States we have found it highly desirable to have at least one government-owned and operated station and our regulations provide that wild ruminants from foot-and-mouth disease or rinderpest infected countries representing an unusual risk, be quarantined at that station. Adequate facilities are available to provide protection not only to prevent escape of diseases from the station but to protect valuable animals in a shipment from infection introduced by other animals undergoing quarantine at the same time. At ports of entry where government owned facilities do not exist, the importer must provide quarantine space subject to the approval of the Department's port veterinarian.

All regulatory control measures to be effective must first of all be realistic. There is no sense in trying to regulate something that cannot or need not be regulated. But, if it is possible and is necessary, then all precautions must be taken.

Preventing the introduction of foreign animal diseases is not a simple matter of setting up a control programme and then going about business as usual. Nor should there be sudden bursts of enthusiasm followed by periods of indifference. It requires steady day-to-day attention to all details in which the only evidence of a job well done is when nothing happens over an extended period of time. Above all, there must be strict and impartial enforcement of the regulations. The exception leads to the breakdown of the entire control programme.

R.C.V.S. RECEPTION

The President of the Royal College of Veterinary Surgeons entertained the President of the British Small Animal Veterinary Association and representatives of the Association at the College on March 19th. He was supported by the Officers and other representatives of the Council of the College, and among the principal guests was the President of the B.V.A.

Current Literature

ABSTRACTS

Genetic Resistance to Uric Nephritis in Chickens. HICKS, A. F., Jr. (1958). *Poult. Sci.* **37.** 1,289-94.

Studies on the flocks of the University of British Columbia showed that nephritis accounted for 16 per cent. of all deaths in adult laying birds. It occurred most frequently in the spring and summer. Nearly 70 per cent. of the cases occurred in the last 4½ months of the laying year, suggesting a breakdown of the excretory system associated with, or following, a sustained period of heavy egg production.

During one year, in which the incidence of nephritis was unusually high, a significant difference was observed in the incidence shown by different breeds and also in that shown by different families within certain breeds. These differences were not apparent in more normal years. It was found possible to increase the incidence of nephritis by selective breeding.

The Zinc Requirement of the Chick. ROBERSON, P. H., & SCHAIBLE, P. J. (1958). *Poult. Sci.* **37.** 1,321-3.

The authors suggest that the zinc requirements of the chick may be higher than was formerly thought. Their experiments indicate that 30 parts per million are required for satisfactory growth. Deficient chicks grew poorly, retained their baby chick down and failed to feather properly, and developed a severe dermatitis of the feet. Some developed gross abnormalities of the leg bones. Zinc sulphate and zinc chloride were equally satisfactory as supplements.

E. A. G.

Promazine as a Pre-anaesthetic agent in Horses— RAKER, C. W., & SAYERS, A. C. (1959). *J.A.V.M.A.* **134.** 23.

Premedication with drugs which produce calmness and relaxation, without depression of the higher cortical centres, has been found very advantageous in both human, and veterinary anaesthesia, but inconsistent results have been obtained with the use of many of these drugs, in horses. The authors found that with promazine administered intravenously at a dosage of 0.5 mg. per 1 lb. bodyweight the maximum effect is always obtained in 15 minutes—chloral hydrate was then used either to produce narcosis, which was combined with local or regional anaesthesia or to produce general anaesthesia. It was administered intravenously and it was found that after premedication with promazine 40% less intravenous anaesthetic was needed to produce the required level of anaesthesia than was needed in horses which had received no premedication. Recovery from anaesthesia when promazine premedication had been used was found to be consistently free from the struggling hitherto experienced in horses. Recovery is also more rapid and the standing position is usually gained within one hour. There is thus a greatly minimised risk of self inflicted trauma.

U. L

Opening of the Second B.S.A.V.A. Congress

As briefly mentioned last week, this Congress was held in the Washington Hotel, London, from March 20th to 22nd, inclusive. It was opened by the B.S.A.V.A. President, Mr. C. E. Woodrow, who, in the course of his official address, said:—

"The story of the development of the Association during the last year I shall leave to our secretary to discuss in his report to the A.G.M. There is, however, one aspect which is of such importance that I would like to refer to it at some length. As a result of the decision of the last A.G.M., we are now a non-territorial Division of the B.V.A. We have 6 representatives on the B.V.A. Council and various committees. This has made a radical change in our approach to political matters. We are free to conduct our internal affairs; to hold regional meetings, an annual congress, and produce a bulletin without any interference or direction from the B.V.A.; but where political matters involve outside societies or bodies there is already in existence the negotiating machinery of the B.V.A. Small Animals Committee. I am sure you will agree that it is more profitable to our Association to make use of, and strengthen, this existing machinery than to take any independent action which cannot, within our limitations, be so effective, and which, without full knowledge of the facts, can well be ill-timed and even disastrous.

"The criticism of the aparent apathy or lack of tangible results of that committee is often due to the lack of interest of individual B.V.A. divisional members, and their failure to ensure that their Divisions pass on to the Small Animals Committee matters of concern to themselves. I know from my short experience of this committee how ready it is to act on any matters referred to it by Divisions, but unless complaints or resolutions are passed on, it is obviously powerless. Again, the ignorance of divisional members of the actions of the Small Animals Committee is often due to the failure of their representatives to return and report on the action taken. This matter will be fully discussed in a session on Sunday morning, and proposals will be made to ensure close contact between our members and the Executive Committee, our B.V.A. representatives, and the Small Animals Committee.

"After the experiment of last year, which showed just how successful a small-animal Congress could be, it is now clear that one of the main objects of the B.S.A.V.A. will always be the arrangement and production of a good yearly Congress. The success of that first Congress and the publication of the Proceedings, which were so admirably edited by our secretary and so well printed and produced, have done a great deal to enhance the scientific reputation of the B.S.A.V.A. at home and abroad.

"Referring to the A.G.M. on Sunday morning we have deliberately timed one of the most interesting sessions for Sunday afternoon, in an effort to keep you all here until the end of the Congress. I refer to the symposium on 'Current Thought on the Major Infectious Diseases of the Dog.' This I think is of the utmost importance and topical interest to all of us engaged in small-animal practice. I had occasion last year in my opening address to refer to the significant omission of any paper on distemper. I expressed the hope that we had succeeded in setting up a barrier by the general adoption of vaccination, a barrier which the distemper virus was finding it difficult to pass. Apart from a slight scare last September, which fortunately was ill-founded, nothing has occurred here in London to make me alter that opinion. I went on to refer to the fact that the control and reduction of one major disease always seemed to high-light the increase or importance of another and introduced a plea for the more general adoption of leptospirosis vaccination. This year I would extend that plea, for in addition to leptospira vaccine we shall have at last a hepatitis vaccine. I understand that two hepatitis vaccines will be introduced, for the first time, at this Congress. This might almost be the theme of this year's Congress: a complete prophylactic programme for the dog. What a challenge to all of us in small-animal practice.

"During the last decade we have read a lot of the increased expectation of life in men and women. Here, surely, is the foundation of increased longevity in the dog, by the prevention of the major infectious diseases in youth with their after effects in later life; the nervous sequelae of distemper; the nephritis of leptospirosis; the liver-damage of hepatitis. We who are in urban practice know full well without being able to quote statistics that the chief causes of death in the ageing canine animal are interstitial nephritis in the dog and endometritis in bitches. By eliminating the chief cause of nephritis and with our greater knowledge of the diet requirements of the chronic nephritic, combined with the recent appreciation of the causal factors of endometritis, the prospects of a longer life for the town dog are surely increasing."

It is hoped to publish a general review of the Congress in the course of the next week or two.

GLASGOW UNIVERSITY V.M.A.

A correspondent writes:—

The first major event of the Candlemas term was the A.V.S. Conference. To this we sent a large contingent of nearly 60 students, and we thoroughly enjoyed our short stay in London. Following the Charities Day on January 31st, our next big social event was the annual ball. It was, as usual, well attended by the staff, graduates, and undergraduates. The ball was the most expensive, and by general agreement, one of the most successful the association has ever held. We were pleased to welcome a representative from the Dick this year.

This session we have been very well represented at the various college social events throughout Britain, having to date sent representatives to Edinburgh, Bristol, Liverpool, and Dublin.

News and Comment

THE DUKE OF GLOUCESTER TO BE PRINCIPAL GUEST ON R.C.V.S. DAY

On Tuesday, June 2nd, the following ceremonies will be held, and as the number of places is limited, members are asked to make early application to the Registrar, 9, Red Lion Square, W.C.1.

Corporate service and commemoration of benefactors in the Queen's Chapel of the Savoy at 11.30 a.m. Admission only by previous reservation. The service is open to members and their wives and to others connected with the profession.

Annual luncheon at the Savoy Hotel at 12.30 for 1 p.m., at which the principal guest will be H.R.H. the Duke of Gloucester. The luncheon is open to members, their wives and their friends, and to others connected with the profession. The cost of the luncheon is 3 guineas per head, and includes cocktails at the reception before the luncheon, choice of red or white wine, or other comparable drinks during the meal, liqueurs with coffee, cigars and cigarettes, and all gratuities. Tickets may be obtained from the College, on receipt of the appropriate remittance.

Annual general meeting at the Royal College at 3.45 p.m., followed by tea. There will also be an historical exhibition. This ceremony is open to members and their wives, and tea is provided for those who have given previous notice of attendance.

CARLSBERG-WELLCOME TRAVELLING RESEARCH FELLOWSHIPS, 1959-60

Applications are invited for the Carlsberg-Wellcome Travelling Research Fellowships, 1959-60, the objects of which are to encourage co-operation, on an exchange basis, between Danish and British research workers in any branch of the natural sciences which has a bearing upon human and animal medicine. One Fellowship annually is awarded to a candidate from the United Kingdom for a year's work in Denmark, and one annually to a Danish candidate for a year's work in the United Kingdom. The stipend may range from £800 to £1,200 per annum (or the equivalent sums in Danish kroner), travelling and some incidental expenses being provided in addition. The tenure of the awards will start in September, 1959.

Enquiries from candidates in the United Kingdom should be addressed to the Assistant Scientific Secretary of the Wellcome Trust, 52, Queen Anne Street, London, W.1, from whom further particulars may be obtained. Completed applications must be submitted before April 30th.

UNIVERSITY NEWS

Edinburgh

The undermentioned candidates have passed in the subject of Physics of the First Professional Examination for the degree of Bachelor of Veterinary Medicine and Surgery:—

Alexander, Richard J.; Bell, Andrew S. W.; Carnegie, David B.; Carstairs, William; Clark, John C.; Cran, Hugh R.; Dale, Stephen J.; Dobson, Keith B.; Eden, Donald T.; Farrell, Janice M. F.; Fielding, Michael J.; Gill, Anthony H.; Harding, Clifford; Henson, Peter M.; Horne, Ann M.; Little, Thomas W. A.; Martin, Stephen J.; Page, Richard W. F. Le; Peele, John C. S.; Stewart, Anthony C.; Thoresen, Aase; Trethewey, John C.; Veitch, Liana M.; Windsor, Roger S.; Wray, Clifford; and Yelland, Patricia A.

The undermentioned candidates have passed in the subject of Veterinary Anatomy and Histology of the Second Professional Examination for the B.V.M. & S. degree:—

Anderson, Euan C.; Arbuckle, James B. R.; Bailey, Sheila A.; Bell, Alastair F.; Blake, George; *Broome, Brenda M.; Browse, Julian S. A. M.; Carwardine, Paul C.; Cooper, Michael J.; Coulthwaite, John R.; Davies, Charles S.; Davies, Lewis D.; Foggie, Janet; Forbes, Derek; Forgrave, Bryan T. G.; Glickman, Murray A.; Haigh, Arthur J. B.; Hargreaves, Charles E.; Hoskin, Brian D.; Jones, Robert A.; Kirk, James O.; Kirkham, John; Lander, Keith P.; MacIntyre, Gerald C.; McNab, Ian; Marsh, Ian A.; Martin, Ronald N.; Meldrum, Keith C.; Mighell, John S.; Muirhead, Michael R.; Paterson, Robin J.; Pearson, Clifford; Pearson, Michael V. M.; Reece, Peter; Robertson, John F.; Rodger, John O. K.; Ross, Ian C.; Sansi, Kamoru A. O.; Sargeant, John P.; Stewart, Colin G.; Stewart, David B.; Sutherland, Stewart D.; Wilson, Michael; and Young, Godfrey F.

* Denotes passed veterinary anatomy and histology with distinction.

The undermentioned candidates have passed in the subject of Veterinary Physiology (including Biochemistry) of the Second Professional Examination for the B.V.M. & S. degree:—

Anderson, Euan C.; Arbuckle, James B. R.; Bailey, Sheila A.; Bell, Alastair F.; Blake, George; Broome, Brenda M.; Carwardine, Paul C.; Cooper, Michael J.; Coulthwaite, John R.; Davies, Charles S.; Foggie, Janet; Forbes, Derek; Glickman, Murray A.; Haigh, Arthur J. B.; Hoskin, Brian D.; Jones, Robert A.; Kirk, James O.; Kirkham, John; Lander, Keith P.; McNab, Ian; Marsh, Ian A.; Martin, Ronald N.; Mighell, John S.; Muirhead, Michael R.; Paterson, Robin J.; Pearson, Clifford; Pearson, Michael V. M.; Reece, Peter; Robertson, John F.; Rodger, John O. K.; Sansi, Kamoru A. O.; Sargeant, John P.; Somerville, James C.; Stewart, Colin G.; Stewart, Hugh D.; Sutherland, Stewart D.; Wheeler, Michael R.; Williamson, Alexander M.; Wilson, Michael; and Young, Godfrey F.

The undermentioned candidates have passed the Third Professional Examination (Part II) in the subjects of Veterinary Pathology, Bacteriology, and Parasitology for the B.V.M. & S. degree:—

Calvert, D. J.; Campbell, E. G.; Dawson, P. S.; Downie, J. G.; Doxey, D. L.; Eyre, Peter; Fairlie, George; Footman, Brian; Gill, K. A. K.; Goad, Lewis; Goodman, A. P.; Harcourt, R. A.; Irwin, V. C. R.; Jackson, P. G. G.; Lowe, W. A.; McIlveen, S. W. D.; Mair, M. L.; Middleton, N. T.; Moar, J. A. E.; Moore, Alexander; Oduro, G. A.; Radley, D. E.; Robson, R. P.; Rollo, D. G.; Smith, Margaret E.; Spence, A. B.; Taylor, S. M.; Thomas, G. W.; Tindall, J. R. and Wilkinson, I. S.

The undermentioned candidates have passed in the subject of Veterinary Pathology of the Third Professional Examination (Part II) for the B.V.M. & S. degree:—

Allsup, T. N.; and Gardner, E. A.

The undermentioned candidates have passed in the subject of Veterinary Bacteriology of the Third

Professional Examination (Part II) for the B.V.M. & S. degree:—

Abbott, J. F. D.; Reeves, R. J. C.; Schermbrucker, C. G.; Searles, Patricia A.; and Somerville, J. R.

The undermentioned candidates have passed in the subject of Veterinary Parasitology of the Third Professional Examination (Part II) for the B.V.M. & S. degree:—

Abbott, J. E. D.; Gardner, E. A.; Reeves, R. J. C.; Schermbrucker, C. G.; Searles, Patricia A.; and Somerville, J. R.

The undermentioned candidates have passed the Part I Examination for the Diploma in Tropical Veterinary Medicine:—

Browne, Vernon A. D., B.SC., M.R.C.V.S.; Chong, Sip Ngow, B.SC., M.R.C.V.S.; Halpin, Francis B.; M.R.C.V.S.; Lal, Munshi, G.B.V.C. (PATNA), B.V.SC. & A.H. (AGRA); Menard, Fernand J. R. R., M.R.C.V.S.; Noble, Neil M., M.R.C.V.S.; Paine, Gordon D., M.R.C.V.S.; Parker, Francis J., M.R.C.V.S.; Peritz, Franz J., M.R.C.V.S.; and Wakeem, Abdallah Asad, B.V.SC. (LIVERPOOL), M.R.C.V.S.

Liverpool

Degree of B.V.Sc.

SECOND EXAMINATION, PART I (VETERINARY ANATOMY, INCLUDING HISTOLOGY AND EMBRYOLOGY)

Bush, B. M.; and Smith, B. J.

SECOND EXAMINATION, PART II (PHYSIOLOGY, INCLUDING BIOCHEMISTRY)

Bush, B. M.; and Smith, B. J.

THIRD EXAMINATION, PART II (VETERINARY PATHOLOGY, INCLUDING MICROBIOLOGY AND PARASITOLOGY)

Allen, W. M.; Batty, A. F.; Capron, T. K.; Chesworth, A. T.; Dawkes, B. H.; Edwards, J. D. D.; Fell, C.; Gyening K. O.; Holt, H. J.; Hopkins, D. L.; Jones, G. W.; Jones, R. S.; Miller, J. K.; Milner, N. A.; Peel, D. R.; Pickup, Pamela; Procter, G.; Rigby, J. P.; Shreeve, B. J.; Taylor, K. C.; Thomas, J. K.; Vaughan, A.; Walker, D.; Walker, J. M.; Zagni, P. A.; and Zanetti, P. J.

THIRD EXAMINATION, PART III (ANIMAL HUSBANDRY INCLUDING GENETICS)

Allen, W. M.; Batty, A. F.; Capron, T. K.; Chesworth, A. T.; Davies, J. O.; Dawkes, B. H.; Edwards, J. D. D.; Evans, W. E. S.; Fell, C.; Fitton, M. W.; Gyening, K. O.; Hardy, B. D. W.; Holt, H. J.; Hopkins, D. L.; Jones, G. W.; Jones, R. S.; Miller, J. K.; Milner, N. A.; Peel, D. R.; Pickup, Pamela; Procter, G.; Rigby, J. P.; Shreeve, B. J.; Taylor, K. C.; Thomas, J. K.; Vaughan, A.; Walker, D.; Walker, J. M.; Zagni, P. A.; and Zanetti, P. J.

THE COLONIAL VETERINARY SERVICE

Promotion (December, 1958)

P. E. Glover, D.SC., M.I.BIOL., assistant director (Zoology), Kenya, becomes chief zoologist, Veterinary Department, Kenya.

(January, 1959)

P. G. Scoggins (ex-St. Lucia, Windward Islands), transfer becomes veterinary officer, Kenya.

New Appointments (March, 1959)

R. M. Griffin, B.V.M. (LONDON), veterinary research officer, Federation of Nigeria; J. F. Montgomery, B.V.M., veterinary officer, Uganda.

IMPORTATION OF STORE CATTLE FROM THE IRISH REPUBLIC

In answer to a Question in the House by Sir Anthony Hurd (March 23rd) about the arrangements under which store cattle from the Irish Republic will be allowed to enter Great Britain when bovine tuberculosis has been for all practical purposes eradicated from this country, Mr. Godber, Joint Parliamentary Secretary to the Ministry of Agriculture, said:—

"The Government have informed the Government of the Irish Republic that for five years after the date on which Great Britain is declared free of bovine tuberculosis we shall be prepared to allow the continued importation of once-tested cattle into Great Britain subject to the same safeguards as apply at present. The arrangements will be subject to annual review. Their purpose is to enable our requirements to be fully met by attested cattle at the end of the five-year period."

ANNUAL BANQUET OF THE KENYA VETERINARY ASSOCIATION

A public tribute to the veterinary profession for its achievements in Kenya was paid by the President of the Royal Agricultural Society of Kenya, Sir Charles Markham, at the annual Banquet of the Kenya Veterinary Association held recently in Nairobi. He said he would like to see closer co-operation between veterinary surgeons in private practice and those working in the Government. Sir Charles was proposing the toast of the Association which was acknowledged by the President, Professor J. B. Polding, Dean of the Makerere College Veterinary Faculty. The guests were welcomed by Mr. R. A. Hammond, and the Minister for Agriculture, the Hon. Michael Blundell, replied.

R.C.V.S. OBITUARY

We record with regret the death of the following member of the profession:—

RUTHERFORD, Zerub Baillie, O.B.E. (Captain late R.A.V.C.), of 48, South Court Avenue, Dorchester. Graduated London, July 17th, 1902. Died March 11th, aged 80 years.

PERSONAL

Mr. G. N. Henderson, formerly veterinary adviser to The Distillers Company (Biochemicals) Limited, has now been appointed manager of the Company's veterinary department. Later this year he will represent DC(B)L at the International Veterinary Congress in Madrid.

Births

ANDERSON.—On March 8th, 1959, to Jean, wife of A. C. Anderson, M.R.C.V.S., of "Glenbrae," Balmoor Terrace, Peterhead, a son, Alexander Ritchie.

CASTLE.—On March 20th, 1959, to Elizabeth Joy Castle, M.R.C.V.S., M.V.SC. (*née* Bailey), and Malcolm Castle of Hilbre, Mount Hamilton, St. Quivox, Ayr, a daughter, sister for Jeremy.

GOURLAY.—To Doreen, wife of R. N. Gourlay, B.SC., M.R.C.V.S., DIP.BACT., on March 7th, 1959, at Kampala, Uganda, a daughter, Sara, sister for David and Alison.

JULL.—On March 15th, 1959, at Charing Cross Hospital, to José, wife of David J. Jull, B.SC., M.R.C.V.S., of 43, Pasture Road, Wembley, Middlesex, a son, brother for Carolyn.

MORRISH.—On March 19th, 1959, to Gillian, wife of John Morrish, B.SC., M.R.C.V.S., of 13, Derby Road, Caversham, Reading, a son, Andrew John.

RATCLIFFE.—On February 27th, 1959, at Llandrindod Wells Memorial Hospital, to Margaret, wife of James Ratcliffe, B.V.M.S., M.R.C.V.S., of 29, Church Street, Farnworth, Bolton, Lancs., a daughter, Susan Haf.

SEDGWICK.—On March 17th, 1959, to Anne Jennifer, R.G.N., and John R. W. Sedgwick, B.SC., M.R.C.V.S., of Walker Street, Cockermouth, a second son.

COMING EVENTS

April

1st (Wed.). Meeting of the R.A.V.C. Division at Glaxo Laboratories Ltd., Greenford, Middlesex, at 11 a.m.

2nd (Thurs.). General Meeting of the Society of Practising Veterinary Surgeons at the Department of Veterinary Surgery, University of Bristol, Langford, Nr. Bristol, 2.30 p.m.

All-day Meeting of the Central Veterinary Society with the South-eastern Metropolitan Orthopaedic Club at the Royal Veterinary College, Camden Town, N.W.1, 12.30 for 1 p.m.

2nd and 3rd (Thurs. and Fri.). The 21st Ordinary General Meeting of the A.V.T. and R.W's. will be held at the Gleneagles Hotel, Scotland, at 10 a.m.

4th (Sat.). Symposium of the Scottish Group of the Nutrition Society in Glasgow.

13th Annual Dinner of the B.R.X. Club at the Royal Veterinary College, 6 p.m.

7th (Tues.). Reception and Dance of the Shropshire Veterinary Club at the Lion Hotel, Shrewsbury, 9 p.m.

8th (Wed.). Special Meeting of the Sussex Veterinary Society at the Old Ship Hotel, Brighton, 2.30 p.m.

10th (Fri.). General Meeting of the Midland Counties Veterinary Association at the Swan Hotel, Stafford, 2.30 p.m.

25th (Sat.). Meeting of the B.S.A.V.A. North West Region at the Stork Hotel, Liverpool.

Annual General Meeting of the Association of State Veterinary Officers in the Auditorium of the Wellcome Research Institute, 183-193, Euston Road, London, N.W.1, 4 p.m.

May

1st (Fri.). Reception and Dance of the Midland Counties Veterinary Association at the Mount Hotel, Tetterhall Wood, Wolverhampton, 9 p.m.

August

30th to 5th September. 77th Annual Congress of the British Veterinary Association in Folkestone. (Official opening Monday, August 31st.)

B.V.A. COMMITTEE AND COUNCIL MEETINGS IN EDINBURGH

Wednesday, April 8th, 1959—at The Royal (Dick) School of Veterinary Studies

10.00 a.m. Farm Livestock Committee.
11.30 a.m. Parliamentary and Public Relations Committee.
2.15 p.m. Small Animals Committee.
5.00 p.m. Finance Sub-committee.

Thursday, April 9th, 1959—at The Royal (Dick) School of Veterinary Studies

10.00 a.m. Home Appointments Committee.
11.30 a.m. Veterinary State Medicine Committee.
2.15 p.m. General Purposes and Finance Committee.

Friday, April 10th, 1959—at The Royal (Dick) School of Veterinary Studies

10.00 a.m. Council Meeting.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Northants. Decoy Farm, Postland, Crowland, Peterborough (Mar. 17).
Suffolk. Blofield Hall Farm, Trimley St. Mary, Ipswich (Mar. 18).
Wigtown. Grennon Farm, Drummore, Stranraer (Mar. 18).

Fowl Pest

Herts. Crib Street, Ware (Mar. 17).

Swine Fever

Derbys. Tinkersick Farm, Brimington Road, Chesterfield (Mar. 17).
Essex. Gateside, Ferry Road, Hullbridge, Hockley (Mar. 19).
Flints. Plas-yn-llan, Nannerch, Mold (Mar. 17).
Lancs. Brewery Farm, Tarbock, Prescot (Mar. 17); Butterlands Farm, Fishwick, Preston (Mar. 19).
Leics. Highfield Farm, Normanton-le-Heath (Mar. 18).
Notts. Stragglethorpe Buildings, Radcliffe-on-Trent (Mar. 19).
Oxford. North Farm, Stonesfield (Mar. 19).
Salop. Lyons Wood Farm, Wem, Shrewsbury (Mar. 18); Church Farm, Preston Gubbals, Shrewsbury; Ley Hill Farm, Cardington, Church Stretton (Mar. 19).
Somerset. Roadhouse Stye, Gills Lane, Rooksbridge, Axbridge (Mar. 19).
Sussex. Tewitts Farm, Easons Green, Framfield, Uckfield (Mar. 17).
Wilts. Calcote Farm, Cote, Devizes (Mar. 18).

IN PARLIAMENT

Warble Fly

SIR A. HURD (March 23rd) asked the Minister of Agriculture, Fisheries and Food what immediate plans he has for the more effective eradication of the warble fly which harasses cattle in the summer months and causes serious losses in the leather industry; whether his attention has been called to the claims made for a chemical spray to prevent warble fly attack; and what other lines of investigation are being pursued.

MR. GODBER: An extensive publicity campaign will again be undertaken to draw the attention of stock owners to the importance of carrying out derris dressings to control warble fly infestation of cattle. Field trials of systemic drugs to destroy the warble fly larvae in cattle are in progress. I have seen an advertisement of a spray claimed to serve the purpose mentioned in the second part of my hon. Friend's Question, but I have no further information about this spray.

SIR A. HURD: Are we getting anywhere in our programme of trying to eradicate the warble fly? We go on year after year with the same kind of programme. Can my hon. Friend tell us when, as with bovine tuberculosis, he hopes to bring an end to this pest?

MR. GODBER: I can understand my hon. Friend's concern about this most important matter. I can assure him that the work on systemic drugs is important. I have seen some of it myself, and I have hopes that we may find a solution.

MR. CHAMPION: In view of the evil of this pest, will not the hon. Gentleman try some other method besides those that he has used in the past, and try to ensure that farmers use the preventives which are available to them?

MR. GODBER: Certainly. If any new preparation is put forward to the Veterinary Therapeutic Testing Board they will be very glad to consider any suggestions which are made to them.

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

The R.C.V.S. and the B.V.A.

Sir,—Will you be kind enough to permit me to reply to Mr. J. R. Mitchell's letter dated December 15th?

With reference to the first paragraph of his letter, in which he says "the British farmer does not need educating by his veterinary surgeon, co-operation and understanding are great," this statement is possibly true in many cases, but it is not the point at issue. The point which I was trying to make is that if every practising veterinary surgeon in Great Britain were to explain to his farmer clients how much worry and financial loss could be saved by a more efficient system of animal disease control, then those gentlemen would exert so much pressure upon their Parliamentary representatives as to bring about an immediate improvement in the situation.

In his second paragraph, he says: "To give as example the way in which the Canadian Government eradicated swine fever (more accurately, hog cholera) conveys precisely nothing!" Maybe it conveys nothing to him, but his viewpoint would be very different if he had invested money in pig raising in the United Kingdom! However, I am firmly convinced that any unprejudiced person reading about the hardships inflicted upon pig raisers in Norfolk by this dread disease (*vide* page 1,231 of THE RECORD dated December 27th last) will agree with me that any well-planned scheme designed to eradicate it, would convey a great deal to these unfortunate people. Incidentally, would he care to state how many outbreaks of hog cholera occurred in 1958 in the Province of Alberta (where he now resides) and how many animals were involved?

For those who doubt the possibility of ever eradicating hog cholera from Great Britain, may I quote the following authoritative statement regarding this disease in the United States, which appeared in the Journal of the American Veterinary Medical Association. Vol. 134, No. 3, dated February 1st, 1959? The article is headed "Swine Losses" by S. H. McNutt, D. V. M. (Madison, Wisconsin).

> "It is the opinion of those who have studied the evidence, that swine brucellosis can be better controlled or even eradicated, with the resulting return of $10 million per year to the industry. Also it is their opinion that hog cholera can be eradicated readily, with a resulting return of $40 million to the industry."

Still on the subject of pigs, I wish to draw attention to that excellent article concerning the new bacon factory in Kenya (published in THE RECORD dated December 27th last), which reflects credit on everyone concerned. From page 1,222 of that article, I quote: "Procedure of inspection and judgement is based upon a code passed by the Legislative Council of Kenya in 1955, *with Rules modelled upon the Meat Legislation of Germany and the U.S.A.*" By implication, this is the most severe indictment of the present lack of a meat inspection system in the United Kingdom that I have ever come across. Perhaps the councils of our two organisations might write to the

Colonial Secretary to enquire how it happened that Kenya chose the meat inspection systems of two foreign countries in preference to that of Great Britain!

With regard to rabies, I believe that Mr. Mitchell is a little unfair to the Canadian Government, for this disease is endemic in almost any country with a sizeable wild animal population, control being rendered difficult by the great distances involved. In Great Britain, the well-settled condition of the countryside, allied to short lines of communication, has greatly eased the task of rabies control. I believe that the Canadian Government is making the best of a bad job in the light of our present knowledge of rabies.

Humane slaughter of animals, although a very desirable objective, is outside the bounds of the present discussion. However, I do believe that this problem will be solved in the forseeable future, as methods for rendering cattle and pigs unconscious before slaughter by means of carbon dioxide gas, are being developed in the U.S.A., and probably in Canada also.

With regard to the "hired hands" system, I have no knowledge of it in Southern California. I therefore wrote to the secretary of the American Veterinary Medical Association to enquire about it; he informs me that he is not familiar with the situation described by Mr. Mitchell.

Lastly, he says "why not give a little appreciation to the R.C.V.S. and B.V.A.?" With reference to this paragraph, the R.C.V.S. are certainly to be commended for bringing about several successful prosecutions against unqualified practitioners, and the B.V.A. for their attempts to raise the salaries of veterinary surgeons employed by the Ministry of Agriculture. However, I shall reserve further appreciation until such time as we have an enthusiastic Professional Secretary conducting a vigorous publicity campaign on behalf of the profession, and until these two bodies consult together with a view to solving the problems facing the profession at the present day. To Mr. Mitchell also some appreciation is due, for without his co-operation this discussion would have been very one-sided!

Last, but by no means least, the Editor of THE RECORD deserves much commendation for his Editorial in the issue dated January 3rd. It is very gratifying to learn that he agrees with my contention regarding the desirability of public relations work for the profession, and also that the status of the latter will be enhanced thereby. Undoubtedly the appointment of a full-time Professional Secretary will take most of the administrative burden off the shoulders of the President of the B.V.A., thus freeing him for the important task of formulating future policy.

Yours faithfully,
J. N. SIMPSON-WHITE.

9,629, San Luis Avenue,
South Gate,
California,
U.S.A.
March 17th, 1959.

Sir,—Mr. Simpson-White asks a number of questions in your issue of March 14th to which he wishes to receive replies from candidates at the forthcoming elections to Council of the Royal College of Veterinary Surgeons. It seems that even an incomplete answer would require several pages of THE RECORD.

However, Sir, may one humbly suggest that these questions would have been better addressed to the B.V.A.? It seems to the writer that the Council and standing committees of the R.C.V.S. are not designed to deal with such questions, while the Council and committees of the B.V.A. are, in fact, so designed. That is not to suggest, however, that the R.C.V.S. should not, on all possible occasions, lend its great moral support to the B.V.A.

In my view, the R.C.V.S. is concerned with, in the first place, its statutory duties, and secondly with ethical matters. Very broadly stated, its statutory duties comprise veterinary education, examination arrangements (including, for example, examination of laymen for meat inspection duties in Northern Ireland), registration of graduates, and disciplinary matters. One does sometime wonder whether its interest in ethics is as strong as one would wish—or whether, in fact, its statutory duties have overshadowed such "old-fashioned" activities.

To return to the questions posed by Mr. Simpson-White, may I suggest that questions 1 and 3 should be the province of the Technical Development Committee and the Veterinary State Medicine Committee of the B.V.A.? Meat inspection has been an abiding problem of the V.S.M. Committee for many years, and a tremendous amount of hard work has been done which might, in fact, bear fruit in the not distant future. The other two questions have exercised the Home Appointments Committee for many years. These assertions can readily be verified by reading the reports on B.V.A. business in the SUPPLEMENTS of THE RECORD. One would like to see, if your editorial space allowed, such similarly complete reports on the deliberations of the R.C.V.S.

Yours faithfully,
EDWARD WILKINSON.

216, Osmaston Road,
Derby.
March 23rd, 1959.

ADVERTISER'S ANNOUNCEMENT

THE DISTILLERS COMPANY (BIOCHEMICALS) LIMITED, Broadway House, The Broadway, Wimbledon, S.W.19, are pleased to announce that they have been appointed the sole distributors in the United Kingdom for the products of The Tasman Vaccine Laboratory Limited of New Zealand. Under this arrangement the following products are now available to the veterinary profession:—

VAXITAS DH. Distemper/Hepatitis Vaccine for the immunisation of puppies against Canine Distemper, Hard Pad, and Infectious Hepatitis.

VAXITAS D. For the immunisation of puppies against Distemper and Hard Pad.

VAXITAS H. For the immunisation of puppies against Canine Virus Hepatitis.

ENTEROVAX. For the immunisation of kittens and young cats against Feline Enteritis (Panleucopenia).